COMPOSITION AND ORIGIN OF DUST IN THE FALL OF BROWN SNOW, NEW HAMPSHIRE AND VERMONT, FEBRUARY 24, 1936

By W. O. ROBINSON

[Bureau of Chemistry and Soils, Washington, D. C., April 1936]

During the night of February 24 and early morning of February 25, 1936, rain, sleet, and snow fell over the region of New Hampshire, Vermont, and northern New York; and at many localities the precipitation was strongly colored brown by admixed dust particles.[1]

Several samples of the dust were submitted to the Bureau of Chemistry and Soils: R. P. Haywood of Keene, N. H., was asked to gather and melt the snow that contained the brown dust and to evaporate the water to obtain the sediment. He kindly did this and sent the samples, but the quantity was too small to permit anything except microscopical examination and certain qualitative tests. Simultaneously with the receipt of Mr. Haywood's sample, two others collected from the same fall of snow were sent in by the Weather Bureau. One of these was from Wells River, Vt., sent by Wendell P. Smith, and the other from Peterboro, N. H., sent by C. L. Whittle. Mr. Smith's sample weighed about a gram and was large enough to permit of the following mechanical analysis by T. M. Shaw of the Bureau of Chemistry and Soils:

	Percent
Larger than 50μ	2.2
Between 50 and 20μ	.7
Between 20 and 10.7μ	28.4
Between 10.7 and 6.6μ	27.6
Between 6.6 and 5.0μ	7.7
Between 5.0 and 3.1μ	18.8
Between 3.1 and 2.0μ	9.2
Less than 2.0μ	5.4

I. C. Brown of the same Bureau reports the following results of mineralogical examination:

1. *Silt of Wells River, Vt., sample.*—Quartz abundant; biotite, opaline material, iron oxide present; few feldspars; organic matter abundant.
2. *Entire quantity, Peterboro. N. H., sample.*—Quartz and feldspars abundant; tourmaline and hypersthene present; also opaline material and silicified organic material characteristic of midwestern soil material. Soil material comparatively undecomposed.
3. *Entire quantity of Keene, N. H., sample.*—Quartz and feldspars abundant; titanite and rutile scarce; opaline and silicified organic remains characteristic of midwestern soils; soil minerals comparatively undecomposed.

Samples 2 and 3 resemble each other closely; the particles are largely of colloidal size. The Wells River sample is comparatively coarse and contains relatively small quantities of colloidal matter (less than 2 μ). It would appear that the meteorological conditions operating caused an air elutriation or mechanical separation of the particles present in the original dust storm, with the result that the larger particles settled around Wells River and the finer particles at Keene and Peterboro. The fall in St. Johnsbury, Vt., was estimated at 10 tons to the square mile. The fall at Keene, N. H. was apparently very much lighter.

The colloidal matter separated from the Wells River sample was analyzed, with the following results:

	Percent
SiO_2	48.9
Al_2O_3	20.4
Fe_2O_3	6.1
CaO	5.4
MgO	3.2
Loss on ignition and undetermined	16.0

The molecular ratio $\frac{SiO_2}{Al_2O_3+Fe_2O_3}$ of soil colloids is a distinguishing soil characteristic, and this ratio varies from above 4 in the pedocals of the west to less than 1 in the lateritic soils of the South. Byers, Alexander, and Holmes (U. S. D. A. Tech. Bul. 484) give a full discussion of the significance of this ratio as differentiating the soils of the various soil groups.

The $\frac{SiO_2}{Al_2O_3+Fe_2O_3}$ ratio of the colloid of the Wells River sample is 3.3. This fact, combined with the high content of lime and the presence of calcium carbonate in all three samples, makes it almost certain that the dust deposited in the storm orginated no farther east than the Missouri River.

The Peterboro sample gave 15.0 percent loss on ignition.

On the basis of an estimated fall of 10 tons to the square mile at St. Johnsbury, Vt., the quantity of elements useful to plants that is transferred by these dust storms is of considerable importance. Qualitative examination of the coarser particles of the Wells River sample indicated that the coarser fractions contain fully as much lime as the colloidal fraction. Assuming that the whole mass of dust contained 5.3 percent CaO, than a fall of 10 tons would enrich a square mile by 1,060 pounds of lime.

[1] See, e. g., H. I. Baldwin, The Fall of Brown Snow in New Hampshire, Science, Apr. 17, 1936, p. 371.

METEOROLOGICAL HISTORY OF THE BROWN SNOWFALL OF FEBRUARY 1936

By HORACE R. BYERS

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The trajectory of the dust-laden air that was involved in this storm may easily be traced back to the "dust bowl" in the neighboring parts of the five States, Colorado, New Mexico, Texas, Oklahoma, and Kansas. An examination of the pilot-balloon observations and the displacements of the pressure systems shows that the air reaching northern New England on the night of February 24–25 started from the above-mentioned area on February 23, at a time when severe dust storms occurred there.

An almost steady current of air from the dust-source region to New England prevailed from February 23 to 25. When the velocities of the wind, which were of the order of magnitude of 50 to 60 miles per hour, are considered, the movement of this air from the vicinity of the Texas Panhandle on February 23 to New England on the 25th is easily accounted for. Air at Amarillo, Tex., at 5 p. m. eastern time on February 23 would have reached central Iowa 12 hours later, would have passed over the